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EXAMINER	
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JIGISH D. TRIVEDI

Appeal 2009-003799
Application 08/915,658
Technology Center 2800

Decided: August 19, 2009

Before LEE E. BARRETT, LANCE LEONARD BARRY, and JAY P. LUCAS, *Administrative Patent Judges*.

BARRY, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

The Patent Examiner rejected claims 31-49. The Appellant appeals therefrom under 35 U.S.C. § 134(a). We have jurisdiction under 35 U.S.C. § 6(b).

INVENTION

The invention at issue on appeal is a local interconnect for an integrated circuit (IC). In the manufacture of ICs, interconnects provide electrical paths between field effect transistors and other devices fabricated on a semiconductor substrate and the external circuitry used to pass data to and from these devices. In particular, polycide structures are commonly used to form the gate of a metal oxide semiconductor field effect transistor (MOSFET). A local interconnect is typically used to connect the polycide gate to active semiconductor areas, such as the source or drain of another MOSFET. A local interconnect may also be used to connect active semiconductor areas to other active semiconductor areas separated by an insulating region, such as a field oxide region.

Titanium silicide ($TiSi_2$) is commonly used as a local interconnect for connecting desired polycide gates and active semiconductor areas. (Spec. at 1.) While $TiSi_2$ is a low resistive conductor, the Appellant asserts that the titanium therein is susceptible to oxidation during and after its formation. (*Id.* at 2.) The resultant titanium dioxide (TiO_2) increases the sheet resistance of the interconnect, he adds, thereby increasing power dissipation and reducing the speed of the device. (*Id.*) Further, the TiO_2 impedes the formation of good electrical contacts on the $TiSi_2$ interconnect and poses adhesion problems when subsequent layers are deposited on top of the interconnect. (*Id.*)

The Appellant's local interconnect is formed from a refractory metal silicide. (*Id.* at 1.) The metal silicide is patterned to form the boundaries of the local interconnect and then reacted with an underlying layer of metal. Silicon from the metal silicide combines with the underlying metal to form another metal silicide. An intermetallic compound of titanium-tungsten (TiW), comprised of metal from the underlying metal layer and metal from the metal silicide, is also formed. The Appellant asserts that the intermetallic TiW reduces the resistance of the local interconnect while also increasing its adhesion characteristics. (*Id.* at 13.)

ILLUSTRATIVE CLAIM

31. A local interconnect comprising:

> a composite structure comprising a first metal silicide, a second metal silicide and an intermetallic compound reducing the resistance of said local interconnect, wherein said intermetallic compound comprises metal from said first metal silicide and metal from said second metal silicide, wherein said intermetallic compound contains no non-metallic materials.

PRIOR ART

Okamoto	US 4,910,578	Mar. 20, 1990
Chung	US 5,094,981	Mar. 10, 1992

REJECTIONS

Claims 31-35, 37, 41-45, and 48-49 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Chung.

Claims 36, 38-40, and 46-47 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chung and Okamoto.

ISSUE

The Examiner makes the following findings.

> Chung et al. teach a composite structure comprising of a first metal silicide or titanium silicide 38A,38B (see col. 5, lines 20-22), a second metal silicide or tungsten silicide 40A, 40B (see col. 5, lines 60-65 and col. 7, lines 53-60) and an intermetallic compound 36A,36B comprises of metal of titanium from the first metal silicide and metal of tungsten from the second metal silicide (see col. 4, lines 55-60).

(Ans. 11.) The Appellant argues that the Examiner makes the following argument "Chung et al. do not anticipate appellant's claims as they do not teach appellant's claimed composite structure, i.e., a first metal silicide, a second metal silicide, and an intermetallic compound which comprises metal from the first metal silicide and metal from the second metal silicide." (Reply Br. 2.) Therefore, the issue before us is whether the Appellant has shown error in the Examiner's finding that Chung discloses a composite structure comprising a first metal silicide, a second metal silicide, and an intermetallic compound comprising metal from a first metal silicide and metal from a second metal silicide.

LAW

"[A]nticipation of a claim under § 102 can be found only if the prior art reference discloses every element of the claim." *In re King*, 801 F.2d 1324, 1326 (Fed. Cir. 1986) (citing *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.,* 730 F.2d 1452, 1458 (Fed. Cir. 1984)).

"[A]bsence from the reference of any claimed element negates anticipation." *Kloster Speedsteel AB v. Crucible, Inc.,* 793 F.2d 1565, 1571 (Fed. Cir. 1986).

FINDINGS OF FACT (FFs)

1. Chung's "invention relates to the manufacture of semiconductor devices and, more particularly, to techniques for use in fabricating the electrical interconnection system of a semiconductor integrated circuit ('IC')." (Col. 1, ll. 8-11.)

2. In fabricating the system "[a] metallic barrier material layer 36 consisting principally of non-titanium refractory material is deposited on Ti layer 34." (Col. 4, ll. 46-48.) "The barrier material should not interact significantly with titanium during the anneal step (described below). Titanium silicidation should take place at a lower temperature than silicidation of the barrier material. The barrier material normally consists principally of tungsten. The main candidates for layer 36 are titanium-tungsten and tungsten itself." (*Id.* ll. 50-57.)

3. "During [a] [rapid thermal annealing], layers 38A of titanium silicide form along the Ti/N+ monosilicon interfaces in the N-channel FET as shown in FIG. 1*d*. A titanium silicide layer 38B grows along the Ti/N+polysilicon interface. Similar silicide growths occur in the P-channel FET." (Col. 5, ll. 20-24.)

4. "A desired interconnect pattern is . . . created in the primary interconnect layer and in layers 36 and 34 by selectively etching them using a suitable photoresist mask." (Col. 5, ll. 57-60.) "Items 40A, 40B, and 40C indicate the remaining portions of the deposited aluminum or Al alloy." (*Id.* ll. 62-64.)

ANALYSIS

As aforementioned, the Examiner reads the claimed first metal silicide on layers 38A and 38B of Chung, the claimed second metal silicide on layers 40A and 40B of the reference, and the claimed intermetallic compound on layers 36A and 36B of Chung. (Ans. 11.) We agree with the Appellant, however, that "[t]here is no teaching or suggestion in Chung et al. that their [barrier] layer 36 is formed from the metal in layer 38 and the metal in layer 40 as asserted by the Examiner." (Reply Br. 2.) To the contrary, the reference teaches that the barrier layer 36 consisting principally of non-titanium refractory material, viz., "titanium-tungsten or tungsten itself." (FF 2.) It also explains that silicidation of the barrier material should not take place. (*Id.*) The Examiner does not allege, let alone show, that the addition of Okamoto cures the aforementioned deficiency of Chung.

CONCLUSION

Based on the aforementioned facts and analysis, we conclude that the Appellant has shown error in the Examiner's finding that Chung discloses a composite structure comprising a first metal silicide, a second metal silicide, and an intermetallic compound comprising metal from a first metal silicide and metal from a second metal silicide.

DECISION

We reverse the rejections of claims 31-49.

REVERSE

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